

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
13 March 2003 (13.03.2003)

PCT

(10) International Publication Number  
**WO 03/020159 A1**

(51) International Patent Classification<sup>7</sup>: **A61C 17/34**

(21) International Application Number: **PCT/SE01/01872**

(22) International Filing Date:  
3 September 2001 (03.09.2001)

(25) Filing Language: **English**

(26) Publication Language: **English**

(71) Applicant (for all designated States except US):  
**NORDICA INTERNATIONAL AB** [SE/SE]; Box  
58, S-163 91 Spånga (SE).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **EK, Peter** [SE/SE];  
Stellavägen 14, S-175 67 Järfälla (SE).

(74) Agent: **EHRNER & DELMAR PATENTBYRÅ AB**;  
Box 103 16, S-100 55 Stockholm (SE).

(81) Designated States (national): **AE, AG, AL, AM, AT** (util-  
ity model), **AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA,**

**CH, CN, CO, CR, CU, CZ** (utility model), **CZ, DE** (util-  
ity model), **DE, DK** (utility model), **DK, DM, DZ, EC, EE**  
(utility model), **EE, ES, FI** (utility model), **FI, GB, GD, GE,**  
**GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ,**  
**LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN,**  
**MW, MX, MZ, NO, NZ, PH, PL, PT, RO, RU, SD, SE, SG,**  
**SI, SK** (utility model), **SK, SL, TJ, TM, TR, TT, TZ, UA,**  
**UG, US, UZ, VN, YU, ZA, ZW.**

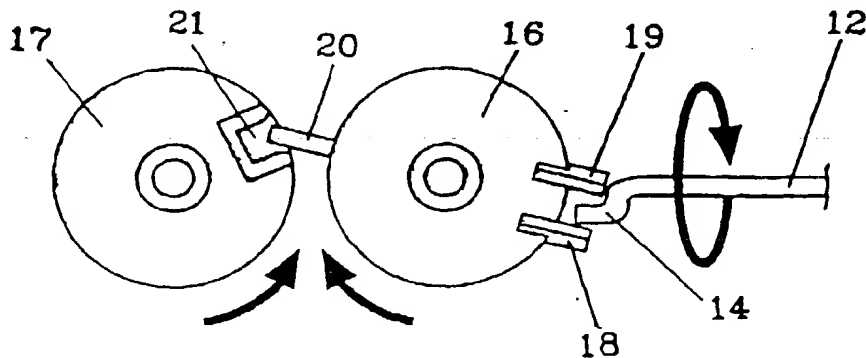
(84) Designated States (regional): ARIPO patent (GH, GM,  
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian  
patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European  
patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE,  
IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF,  
CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD,  
TG).

**Published:**

- with international search report
- with amended claims

For two-letter codes and other abbreviations, refer to the "Guid-  
ance Notes on Codes and Abbreviations" appearing at the begin-  
ning of each regular issue of the PCT Gazette.

(54) Title: **ELECTRIC TOOTHBRUSH**



(57) Abstract: An electric toothbrush has an elongate shank (11) and a cranked drive shaft (12). A pair of pressed lugs (18, 19) are mounted on a periphery of a brush head (16) that are engaged by the shaft to cause the brush head (16) to oscillate when the shaft (12) is rotated. The brush head (16) has a rigid mechanical link that oscillates a brush head (17) in turn.

WO 03/020159 A1

**ELECTRIC TOOTHBRUSH**

The invention relates to electric toothbrushes.

5 Electric toothbrushes are known and widely used having a set of bristles mounted to a brush head that is driven by an electric motor inside a toothbrush handle. The motor may be powered by a battery, also inside the handle, or from a power supply socket adjacent a point-of-use. The brush heads are rotated and/or vibrated by the motor to enhance the operation of  
10 the toothbrushes for cleaning teeth. For vibrating a brush head, it is already known to provide various mechanical couplings, including gears, to convert rotational motion of the motor into oscillating motion at the brush head. Such mechanical couplings tend to be complex, possibly unreliable, or expensive.  
15

It is an object of the invention to overcome or at least reduce such problems.

20

According to the invention there is provided an electric toothbrush having a handle and an elongate shank having a longitudinal axis, an electric motor, an elongate drive shaft rotatable about the longitudinal axis with a laterally off-set  
25 pusher at its remote end, a brush head mounted to the shank to rotate about a laterally extending axis, a pair of vertically opposed lugs at opposed sides of the longitudinal axis mounted to a periphery of the brush head for intermittent mechanical engagement by the pusher, such that when the shaft is rotated  
30 by the motor the brush head is rotationally oscillated.

The lugs preferably have arcuate bearing surfaces against which the pusher intermittently bears in turn as the shaft rotates.

- 5 The arcuate surfaces are preferably shaped in such a manner that during each time the lugs are urged by the pusher the brush head is substantially uniformly rotationally accelerated from rest.
- 10 Two rotatable brush heads may be supported by the shank in which the second brush head is oscillated by a link member that extends between the said brush head to transfer oscillations for the said brush head to the second brush head.
- 15 The second brush head may be mounted to rotate about a substantially vertical axis that is angled to some extent with respect to the rotational axis of the said brush head.

Each of the brush heads may have a tuft block base and a removable tuft block that releasably fits into the tuft block base.

20

Toothbrushes according to the invention will now be described by way of example with reference to accompanying drawings in which:

25

Figure 1 is a sectional top plan view of the toothbrush.

Figure 2 is an isometric side view of an end of a shank of the toothbrush.

30

Figure 3 is a schematic plan view of a rotational drive arrangement of the toothbrush.

Figure 4 is a side view of the rotational drive arrangement;  
and

- 5 Figure 5 is an exploded view of a toothbrush head for the toothbrush.

Figure 5a is an illustration of a preferred embodiment of the lugs.

10

Referring to the drawings, in Figure 1 the toothbrush has a handle 10 and an elongate shank 11 having a central longitudinal axis A. A drive shaft 12 is supported to rotate about the longitudinal axis A and is coupled to a rotor of an electric motor 13 mounted inside the handle. The drive shaft has crank 14 at its remote end forming an off-set pusher. Batteries 15 are housed inside the handle 10 for supplying power to the motor 13.

- 20 Two in-line brush heads 16 and 17 are shown in Figures 1 and 2 vertically rotatably mounted to adjacent an end of the shank 11. It will be noted that the axis of rotation of the brush heads are angled to some extent with one another to enable the brushing action to move conveniently fit to a normal tooth configuration of a user. The brush head 16 has two vertically opposed lugs 18 and 19 mounted to a peripheral surface of the brush head for engagement by the pusher 14 when the drive shaft rotates. This causes the brush head 16 to rotationally oscillate when the drive shaft 12 is rotated by the motor 13.
- 25
- 30 The brush head 16 is also provided with a rigidly connected link 20 extending towards and into an open slot 21 in a peripheral surface of the brush head 17.

The mechanical connections between the drive shaft 12 and the brush heads is clearly seen in Figures 3 and 4. When the drive shaft 12 rotates, the cranked end or pusher 14 intermittently and in turn moves the lugs 18 and 19 sideways, in opposite directions, to cause the brush head 16 to oscillate back and forth. As the brush head 16 oscillates, the link 20 moves back and forth about an arc and by engaging in the slot 21 causes the brush head 17 to oscillate. The brush heads are preferably integrally formed with stub axles 21 and 22 that have bearing surfaces and that snap fit into appropriate and respective apertures (not shown) formed in the shank 11.

In Figure 5, it will be noted that the lugs 18 and 19 are vertically opposed with facing surfaces that are arcuate. Preferably the arcuate surfaces are curved such that when the pusher 14 engages each arcuate surface, in turn, the appropriate lug is moved laterally to one respective side with a generally uniform acceleration starting from rest. This reduces noise and makes the transfer of movement between the pusher 14 and the lugs 18 and 19 more efficient.

In a preferred embodiment, shown in Figure 5a, the inner surface 30 of the arcuate lugs, against which the pusher is arranged to push, has a pusher entry side 31 and a pusher exit side 32. The entry side of the inner surface is angled outwards to some extent in respect to a plane extending through the longitudinal axis A of the elongate shank and a laterally extending axis B, when the lugs are in the position where the longitudinal axis extends in the middle of the space between the lugs. The exit side is parallel to the said plane. This reduces noise and improves the transfer of movement between the pusher 14 and the lugs 18 and 19 even further.

It will also be noted that the lug 18 is vertically lower than the lug 19 to ensure, for clockwise rotation of the pusher 14, that the pusher does not jam. For anticlockwise rotation, the lug 19 is fixed, or integrally formed, in a position appropriately lower than the lug 18. In any event, the complete vertical separation extending between the lugs 18 and 19 makes it unlikely that debris will collect or that the toothbrush cannot be easily cleaned in order to remove any debris that does collect around the pusher 14 and prevents the pusher being readily rotated to carry out its function.

Figure 5 shows that the brush head 16 (or 17) is formed in two separable parts, a tuft block base 23 and a tuft block 24. The base 23 has apertures 25 to receive integrally formed stubs 26. Raised lips 27 are formed on the inside of the base serve to overlap a peripheral skirt 28 on the tuft block to hold the tuft block down in the base 23. A recess 29 allows a blunt instrument, screw driver tip say, to enter under the skirt 28 for prising the tuft block 24 upwards over the lips 27 to facilitate removal of the tuft block when required.

It will be noted that in the described toothbrush two brush heads are used. It is possible to have only one brush head, or three or more. In the latter cases, the brush head (with lugs) is used to pass oscillatory drive to the other brush heads via suitable links 20.

The pusher 14 is provided above by a cranked end of the drive shaft 12. Other forms of pusher may be used including a short piece of shaft welded at one side to an end of a straight or uncranked drive shaft. A noncircular disc can also be used that is mounted on or integrally formed at end of the drive

shaft. A circular disc may be used where the disc is mounted off-centre adjacent the end of the drive shaft 12.

In an alternative embodiment the pusher is arranged to push  
5 against the outside surfaces of the lugs (18, 19), instead of the inside, in order to cause the brush head (16) to oscillate.

The described lugs have arcuate shaft-engaging surfaces. It  
10 will be appreciated that planar shaft-engaging surfaces may be used, although as mentioned above, such surfaces may cause more noise to be generated in operation. In this case and indeed in the described embodiment, the separation between the lugs can be relatively significant (allowing easy removal of  
15 debris if required) because effective practical oscillations of the brush head overall can be achieved through an overall arc of around 20°.

## CLAIMS:

1. An electric toothbrush having a handle (10) and an elongate shank (11) having a longitudinal axis (A), an electric motor (13), an elongate drive shaft (12) rotatable about the longitudinal axis (A) with a laterally off-set pusher (14) at its remote end, at least one brush head (16) mounted to the shank (11) to rotate about a laterally extending axis, characterized in that a pair of vertically opposed lugs (18, 19) at opposed sides of the longitudinal axis (A) are mounted to a periphery of the at least one brush head (16) for intermittent mechanical engagement by the pusher (14) such that when the shaft (12) is rotated by the motor (13) the at least one brush head (16) is rotationally oscillated.
2. An electric toothbrush according to claim 1, characterized in that the lugs (18, 19) have arcuate bearing surfaces against which the pusher (14) intermittently bears in turn as the shaft (12) rotates.
3. An electric toothbrush according to claim 2, characterized in that the arcuate surfaces are shaped in such a manner that during each time the lugs (18, 19) are urged by the pusher (14) the brush head (16) is substantially uniformly rotationally accelerated from rest.
4. An electric toothbrush according to claim 1, characterized in that it includes two rotatable brush heads (16, 17) supported by the shank (11) in which the second brush head (17) is oscillated by a link member that extends between the brush heads (16, 17) to transfer oscillations for the brush head (16) to the second brush head (17).



5. An electrical toothbrush according to claim 4, characterized in that the second brush head (17) is mounted to rotate about a substantially vertical axis that is angled to some extent with respect to the rotational axis of the said brush head (16).

6. An electrical toothbrush according to any of claims 1 to 5, characterized in that each of the brush heads (16, 17) have a tuft block base (23) and a removable tuft block (24) that releasable fits into the tuft block base.

**AMENDED CLAIMS**

[received by the International Bureau on 16 March 2002 (16.03.02);  
original claim 1 amended; remaining claims unchanged (1 page)]

1. An electric toothbrush having a handle (10) and an elongate shank (11) having a longitudinal axis (A), an electric motor (13), an elongate drive shaft (12) rotatable about the longitudinal axis (A) with a laterally off-set pusher (14) at its remote end, at least one brush head (16) mounted to the shank (11) to rotate about a laterally extending axis, a pair of opposed lugs (18, 19) connected to the at least one brush head (16) for mechanical engagement between them by the pusher (14) such that when the shaft (12) is rotated by the motor (13) the at least one brush head (16) is rotationally oscillated, characterized in that the lugs (18, 19) protrude from the periphery side of the brush head (16) and form a slot which is perpendicular to the drive shaft (12).

2. An electric toothbrush according to claim 1, characterized in that the lugs (18, 19) have arcuate bearing surfaces against which the pusher (14) intermittently bears in turn as the shaft (12) rotates.

3. An electric toothbrush according to claim 2, characterized in that the arcuate surfaces are shaped in such a manner that during each time the lugs (18, 19) are urged by the pusher (14) the brush head (16) is substantially uniformly rotationally accelerated from rest.

4. An electric toothbrush according to claim 1, characterized in that it includes two rotatable brush heads (16, 17) supported by the shank (11) in which the second brush head (17) is oscillated by a link member that extends between the brush heads (16, 17) to transfer oscillations for the brush head (16) to the second brush head (17).

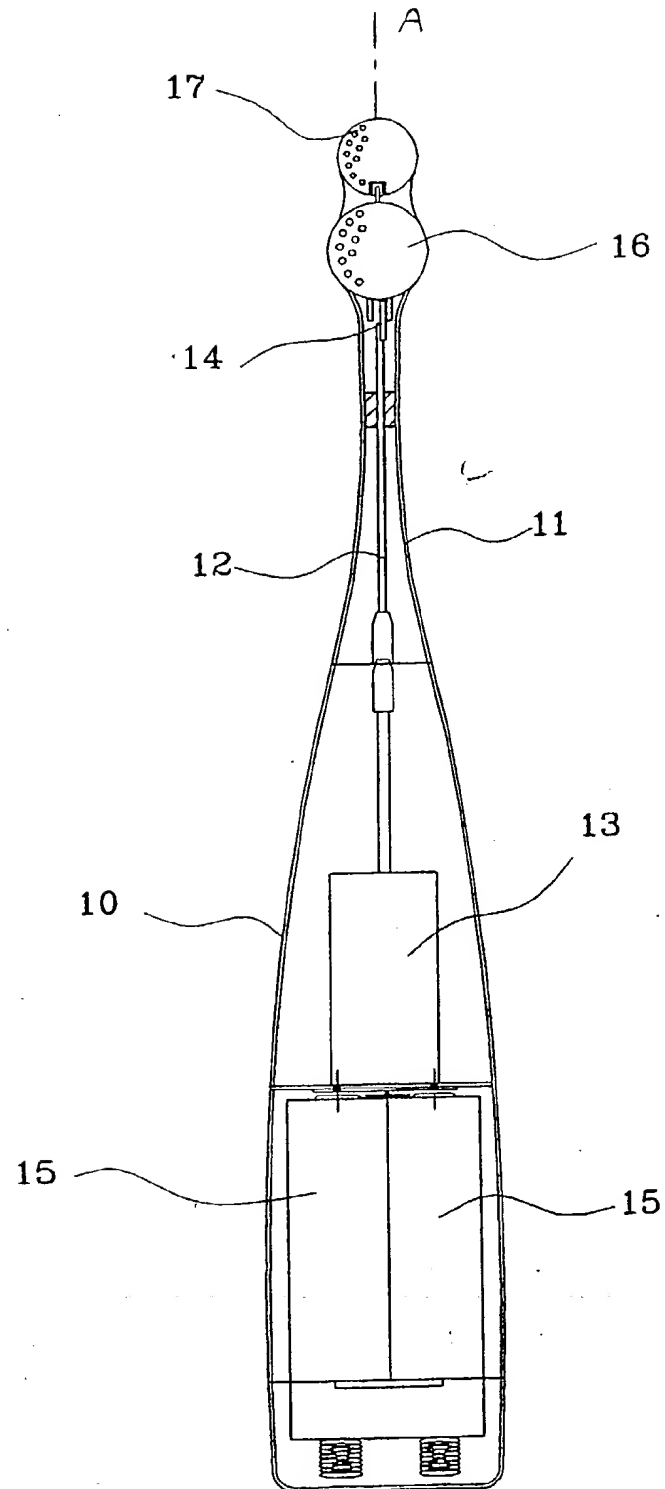


Fig. 1

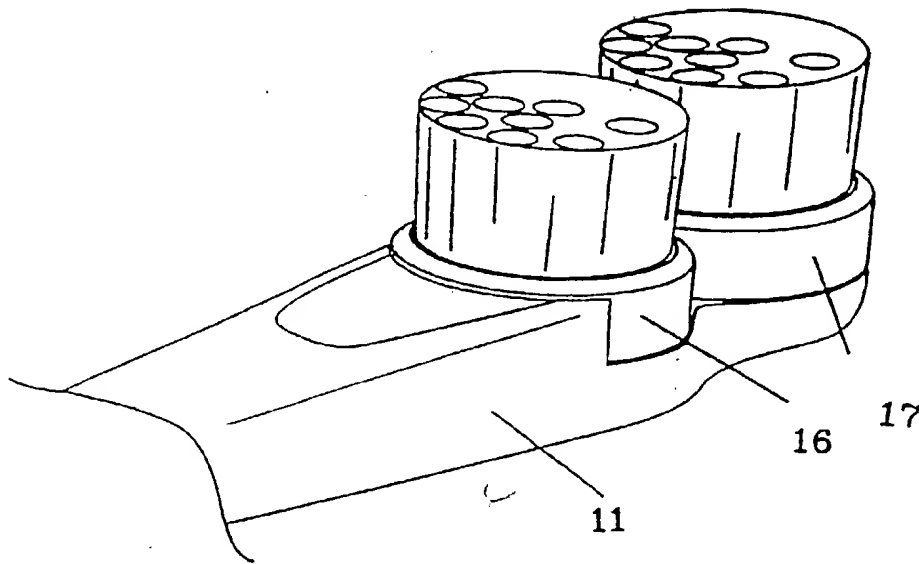


Fig. 2

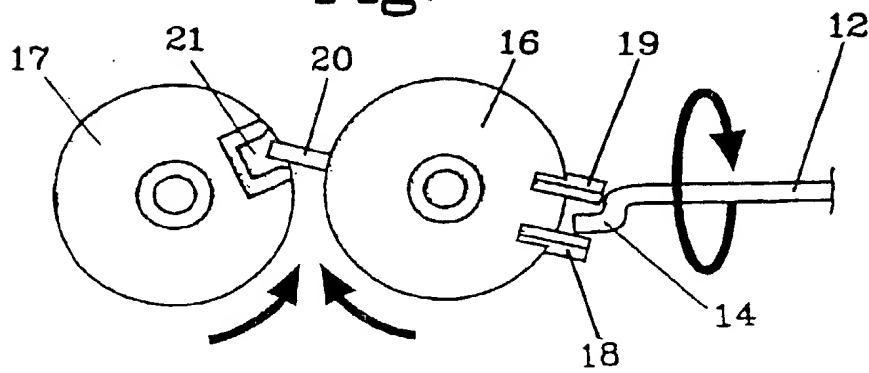


Fig. 3

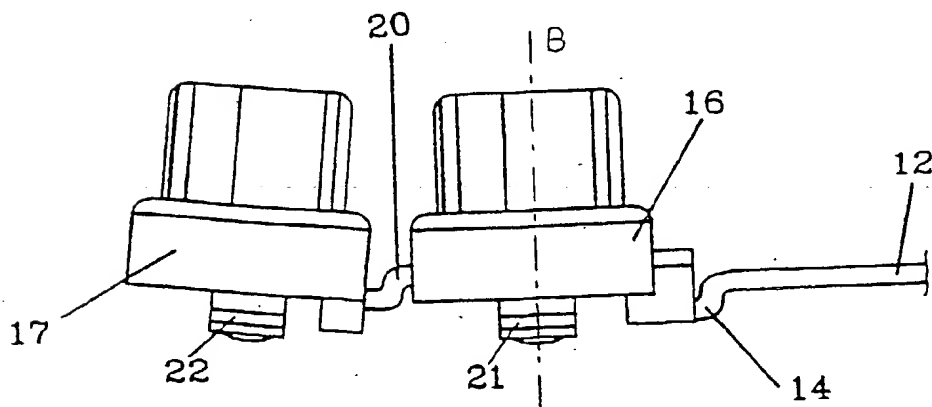


Fig. 4

# INTERNATIONAL SEARCH REPORT

Information on patent family members

06/11/01

International application No.

PCT/SE 01/01872

Patent document cited in search report			Publication date	Patent family member(s)	Publication date
US	5784743	A	28/07/98	NONE	
US	200010004781	A1	28/06/01	NONE	
US	5876206	A	02/03/99	AT 175565 T	15/01/99
				AU 6281194 A	08/11/94
				CN 1105173 A	12/07/95
				DE 59407638 D	00/00/00
				EP 0645988 A,B	05/04/95
				SE 0645988 T3	
				JP 7507956 T	07/09/95
				WO 9423667 A	27/10/94
US	5504958	A	09/04/96	AT 167043 T	15/06/98
				DE 4343103 A	22/06/95
				DE 59406204 D	00/00/00
				EP 0663192 A,B	19/07/95